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IB Mathematics Standard Level - Statistics Unit - Online Instruction

Alexa Miles

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A Mathematics Education Remote Teacher Work Sample

Submitted in Partial Fulfillment of the Requirements for Graduation in the Adolescence Inclusive Mathematics Generalist Education Program

by

Alexa Laine Miles

Major in Mathematics

Adolescence Inclusive Mathematics Generalist Education Program

Department of Education & Human Development

SUNY Brockport

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Overview

This statistics unit is designed to be delivered 100% remotely for IB Math SL students. For our class this was Unit 11. There are five lessons of content in this unit being, 11.1 Histograms and Boxplots, 11.2 Variance and Standard Deviation, 11.3 Probability Distributions and Expected Value, 11.4 Binomial Distribution, and 11.5 Normal Distribution. Each lesson consists of one Edpuzzle video for the students to watch and take notes on and one worksheet style practice assignment (informal assessment) for the students to complete. There is one formal assessment after lesson 2 and a larger (two-day) formal assessment after lesson 5. The assessments are typical exam style assessments. There are two days of review built in before the large end-of-unit assessment including a Quizizz game and a sheet of IB review problems. Each day should be about one hour of work time. Full delivery of this unit should take 10 hours.

Online Resources

This section serves to describe a few of the online resources you and your students should be familiar with prior to beginning work in this unit.

Google Classroom – This is the method we use to deliver assignments to our students. If you have another method in place feel free to use that. If you do not have a method to assign online assignments, I highly recommend setting up a Google Classroom for your students and familiarizing yourself with its functions.

Google Docs – I create weekly agendas for the students to help them keep organized. This is optional, but I would recommend using this to give your students an overview of the week. Here is an example of one of mine.

Zoom – This is a great program for easy video chatting. There are many options such as screen sharing, hand raising, and break-out rooms that make this a customizable online classroom.

Edpuzzle – The links to the Edpuzzle videos are included so once your Edpuzzle is set up with your students imported you can assign the video to them and track their progress. There are short questions in the videos that will pop up and prompt the students to answer before continuing on in the video.

Kami – This is a chrome extension that you and your students should download. You can upload ANY pdf to Google Classroom and it will make a copy for each student. The students can then complete this assignment right on a touch screen computer or tablet. The program allows you to write with a pen, highlight, type words and more. If touch screen is unavailable students can print the assignment, complete and upload it back into Kami. Once submitted the instructor can then write right on the document or provide typed or audio comments as feedback.

TI-Nspire – This is the graphing calculator used by the students in my school. The Edpuzzle videos align to this calculator however many of the functions can be performed on Desmos (see next) when there is no calculator availability.

Desmos – This has a plethora of online resources. Desmos provides a great scientific calculator and graphing calculator. Higher functions are also provided including binomial distribution and normal distribution calculations. This provides a great option for students who do not have a TI–Nspire calculator.

Quizizz – The link to the instructor version of the Quizizz is provided. You simply assign this quiz and provide your students with the link. When the students are completing the review, they can see where they stand on the leaderboard which incorporates a fun game aspect to the review. After the assignment closes you can view a detailed report of each students' answers, time spent, overall score, etc.

Modifications for Students with Disabilities

To support the needs of students with disabilities the videos are open to the students and can be viewed an unlimited number of times. This means that if a student is struggling with a topic, they can view the video as many times as they need to understand the material. Another way these students are supported is that there is no time limit on the assignments. They have a due date, but I typically assign assignments anywhere from two to seven days in advance giving all students ample time to work on, and complete assignments. Finally, I hold office hours via Zoom video chat once a week for students to join and ask any questions they may have. This is a time for students to receive additional help and guidance on any of the material.

Context for Learning

This section serves to provide a context for the classroom this unit was developed for.

About the School Where You Are Teaching

1. In what type of school do you teach?

[High school]

2. Where is the school where you are teaching located?

[Town]

3. List any special features of your school or classroom setting that will affect your teaching in this learning segment.

[This is a medium sized school district in upstate NY that has 4,342 students, of which 89.2% are White. This high school has 1,439 students, of which 89.2% are also White. Due to COVID-19 instruction has moved 100% online. There are no in person meetings from mid-March until the conclusion of the school year.]

4. Describe any district, school, or cooperating teacher requirements or expectations that might affect your planning or delivery of instruction, such as required curricula, pacing plan, use of specific instructional strategies, or standardized tests.

[There are a set of standards from IB that the course must cover in preparation for the IB Exam at the end of the school year. The curriculum comes from a textbook by Haese Mathematics entitled "Mathematics for the international student: Mathematics SL: third edition" (2012).]

About the Class Featured in this Learning Segment

1. What is the name of this course?

[IB Mathematics Standard Level]

2. What is the length of the course?

[One year]

3. What is the class schedule?

[Traditionally the class is held 55 minutes three days a week and 40 minutes one day a week. Due to COVID-19 and the switch to distance learning we now assign the class 2 hours of work per week (2 lessons from this unit plan) as directed by administration.]

4. Is there any ability grouping or tracking in mathematics? If so, please describe how it affects your class.

[This class is designed for strong mathematics students. The majority of the class are students that have been accelerated in mathematics classes since 8th grade. The class is also available to anyone who has not been accelerated, but few take on the challenge.]

5. Identify any textbook or instructional program you primarily use for mathematics instruction.

[The curriculum comes from a textbook by Haese Mathematics entitled "Mathematics for the international student: Mathematics SL: third edition" (2012).]

6. List other resources you use for mathematics instruction in this class.

[Each student is issued their own personal Chromebook laptop with touch screen capabilities. The specific programs used on the Chromebooks are listed and discussed in depth in the section "Online Resources".]

About the Students in the Class Featured in this Learning Segment

1. Grade-level composition:

[mainly juniors with a few seniors]

2. Number of
    - students in the class: 37
    - males: 15 females: 22
3. Summarize required or needed supports, accommodations, or modifications for your students that will affect your instruction in this learning segment.

[1 student with a 504 Plan - Accommodations include extended time on assessments and assessments read to them.]

10 Day Unit Plan

Day 1: 11.1 Histograms and Boxplots (60 mins)

Standards:

- 5.1: Concepts of population, sample, random sample, discrete and continuous data. Presentation of data: frequency distributions (tables); frequency histograms with equal class intervals; box-and-whisker plots; outliers. Grouped data: use of mid-interval values for calculations; interval width; upper and lower interval boundaries; modal class.
- 5.2: Statistical measures and their interpretations. Central tendency: mean, median, mode. Quartiles, percentiles. Dispersion: range, interquartile range.
- 5.3: Cumulative frequency; cumulative frequency graphs; use to find median, quartiles, percentiles.

Objectives:

Students will be able to...

- interpret frequency tables, frequency histograms, and cumulative frequency graphs
- determine if there are outliers present in a data set
- create boxplots based on given information

Materials:

- 11.1 Notes Edpuzzle Video (13:24)
- 11.1 Practice Assignment (informal assessment)
- 11.1 Practice Assignment Key

Facilitator Guide:

- The teacher will assign the **11.1 Notes Edpuzzle Video**.
- The students will watch the Edpuzzle video and take their own notes in a notebook. They will answer any of the questions that pop up during the video. **(20 mins)**
- The teacher will upload and assign the **11.1 Practice Assignment**.
- The students will open and complete the assignment in Kami. **(40 mins)**

- The teacher will open the assignments once turned in and provide feedback to students.
- The teacher will post the **11.1 Practice Assignment Key** for the students to check and correct their work.
- The student will respond to feedback and make corrections using the key.

Day 2: 11.2 Variance and Standard Deviation (60 mins)

Standards:

- 5.2: Dispersion: variance, standard deviation.

Objectives:

Students will be able to...

- determine variance and standard deviation for a data set

Materials:

- 11.2 Notes Edpuzzle Video (12:51)
- 11.2 Practice Assignment (informal assessment)
- 11.2 Practice Assignment Key

Facilitator Guide:

- The teacher will assign the **11.2 Notes Edpuzzle Video**.
- The students will watch the Edpuzzle video and take their own notes in a notebook. They will answer any of the questions that pop up during the video. **(20 mins)**
- The teacher will upload and assign the **11.2 Practice Assignment**.
- The students will open and complete the assignment in Kami. **(40 mins)**
- The teacher will open the assignments once turned in and provide feedback to students.
- The teacher will post the **11.2 Practice Assignment Key** for the students to check and correct their work.
- The student will respond to feedback and make corrections using the key.

Day 3: 11.1–11.2 Concept Check (60 mins)

Standards:

- 5.1: Concepts of population, sample, random sample, discrete and continuous data. Presentation of data: frequency distributions (tables); frequency histograms with equal class intervals; box-and-whisker plots; outliers. Grouped data: use of mid-interval values for calculations; interval width; upper and lower interval boundaries; modal class.
- 5.2: Statistical measures and their interpretations. Central tendency: mean, median, mode. Quartiles, percentiles. Dispersion: range, interquartile range, variance, standard deviation.
- 5.3: Cumulative frequency; cumulative frequency graphs; use to find median, quartiles, percentiles.

Objectives:

Students will be able to...

- interpret frequency tables, frequency histograms, and cumulative frequency graphs
- determine if there are outliers present in a data set
- create boxplots based on given information
- determine variance and standard deviation for a data set

Materials:

- 11.1–11.2 Concept Check (formal assessment)
- 11.1–11.2 Concept Check Key

Facilitator Guide:

- The teacher will assign the **11.1–11.2 Concept Check.**
- The students will complete the concept check in Kami. **(60 mins)**
- The teacher will use the **11.1–11.2 Concept Check Key** to grade the concept checks and provide feedback to the students.
- The students will respond to the feedback accordingly.

Day 4: 11.3 Probability Distributions and Expected Value (60 mins)

Standards:

- 5.7: Concept of discrete random variables and their probability distributions. Expected value (mean), E(X) for discrete data.

Objectives:

Students will be able to...

- create probability distributions to represent different scenarios
- find the expected value of a data set based on a probability distribution

Materials:

- 11.3 Notes Edpuzzle Video (8:43)
- 11.3 Practice Assignment (informal assessment)
- 11.3 Practice Assignment Key

Facilitator Guide:

- The teacher will assign the **11.3 Notes Edpuzzle Video**.
- The students will watch the Edpuzzle video and take their own notes in a notebook. They will answer any of the questions that pop up during the video. **(20 mins)**
- The teacher will upload and assign the **11.3 Practice Assignment**.
- The students will open and complete the assignment in Kami. **(40 mins)**
- The teacher will open the assignments once turned in and provide feedback to students.
- The teacher will post the **11.3 Practice Assignment Key** for the students to check and correct their work.
- The student will respond to feedback and make corrections using the key.

Day 5: 11.4 Binomial Distribution (60 mins)

Standards:

- 5.8: Binomial distribution. Mean and variance of the binomial distribution.

Objectives:

Students will be able to...

- calculate the probability of binomially distributed events
- calculate expected value and variance given a binomial distribution

Materials:

- 11.4 Notes Edpuzzle Video (10:37)
- 11.4 Practice Assignment (informal assessment)
- 11.4 Practice Assignment Key

Facilitator Guide:

- The teacher will assign the **11.4 Notes Edpuzzle Video**.
- The students will watch the Edpuzzle video and take their own notes in a notebook. They will answer any of the questions that pop up during the video. **(20 mins)**
- The teacher will upload and assign the **11.4 Practice Assignment**.
- The students will open and complete the assignment in Kami. **(40 mins)**
- The teacher will open the assignments once turned in and provide feedback to students.
- The teacher will post the **11.4 Practice Assignment Key** for the students to check and correct their work.
- The student will respond to feedback and make corrections using the key.

Day 6: 11.5 Normal Distribution (60 mins)

Standards:

- 5.9: Normal distributions and curves. Standardization of normal variables (z-values, z-scores). Properties of the normal distribution.

Objectives:

Students will be able to...

- calculate the probability of normally distributed events
- calculate expected value and variance given a normal distribution

Materials:

- 11.5 Notes Edpuzzle Video (17:48)
- 11.5 Practice Assignment (informal assessment)
- 11.5 Practice Assignment Key
- 11.5 Calculator Cheat Sheet

Facilitator Guide:

- The teacher will assign the **11.5 Notes Edpuzzle Video**.
- The teacher will post the **11.5 Calculator Cheat Sheet** as a student resource.
- The students will watch the Edpuzzle video and take their own notes in a notebook. They will answer any of the questions that pop up during the video. **(20 mins)**
- The teacher will upload and assign the **11.5 Practice Assignment**.
- The students will open and complete the assignment in Kami. **(40 mins)**
- The teacher will open the assignments once turned in and provide feedback to students.
- The teacher will post the **11.5 Practice Assignment Key** for the students to check and correct their work.
- The student will respond to feedback and make corrections using the key.

Day 7: Unit 11 Review Part 1 (60 mins)

Standards:

- 5.1: Concepts of population, sample, random sample, discrete and continuous data. Presentation of data: frequency distributions (tables); frequency histograms with equal class intervals; box-and-whisker plots; outliers. Grouped data: use of mid-interval values for calculations; interval width; upper and lower interval boundaries; modal class.
- 5.2: Statistical measures and their interpretations. Central tendency: mean, median, mode. Quartiles, percentiles. Dispersion: range, interquartile range, variance, standard deviation.
- 5.3: Cumulative frequency; cumulative frequency graphs; use to find median, quartiles, percentiles
- 5.7: Concept of discrete random variables and their probability distributions. Expected value (mean), E(X) for discrete data.
- 5.8: Binomial distribution. Mean and variance of the binomial distribution.
- 5.9: Normal distributions and curves. Standardization of normal variables (z-values, z-scores). Properties of the normal distribution.

Objectives:

Students will be able to...

- interpret frequency tables, frequency histograms, and cumulative frequency graphs
- determine if there are outliers present in a data set
- create boxplots based on given information
- determine variance and standard deviation for a data set
- create probability distributions to represent different scenarios
- find the expected value of a data set based on a probability distribution
- calculate the probability of binomially distributed events
- calculate expected value and variance given a binomial distribution
- calculate the probability of normally distributed events
- calculate expected value and variance given a normal distribution

Materials:

- Quizizz Review Instructor Version (Editable) (informal assessment)

Facilitator Guide:

- The teacher will assign the **Quizizz Review** and provide the students with the link to access the review.
- The students will complete the review activity. **(60 mins)**
- The teacher will track student progress on the Quizizz website.

Day 8: Unit 11 Review Part 2 (60 mins)

Standards:

- 5.1: Concepts of population, sample, random sample, discrete and continuous data. Presentation of data: frequency distributions (tables); frequency histograms with equal class intervals; box-and-whisker plots; outliers. Grouped data: use of mid-interval values for calculations; interval width; upper and lower interval boundaries; modal class.
- 5.2: Statistical measures and their interpretations. Central tendency: mean, median, mode. Quartiles, percentiles. Dispersion: range, interquartile range, variance, standard deviation.
- 5.3: Cumulative frequency; cumulative frequency graphs; use to find median, quartiles, percentiles
- 5.7: Concept of discrete random variables and their probability distributions. Expected value (mean), E(X) for discrete data.
- 5.8: Binomial distribution. Mean and variance of the binomial distribution.
- 5.9: Normal distributions and curves. Standardization of normal variables (z-values, z-scores). Properties of the normal distribution.

Objectives:

Students will be able to...

- interpret frequency tables, frequency histograms, and cumulative frequency graphs
- determine if there are outliers present in a data set
- create boxplots based on given information
- determine variance and standard deviation for a data set
- create probability distributions to represent different scenarios
- find the expected value of a data set based on a probability distribution
- calculate the probability of binomially distributed events
- calculate expected value and variance given a binomial distribution
- calculate the probability of normally distributed events
- calculate expected value and variance given a normal distribution

Materials:

- 11 Review Problems(Alei) (informal assessment)

Facilitator Guide:

- The teacher will assign **11 Review Problems**.
- The students will complete the review problems and check over their answers using the key attached in the document. **(60 mins)**

Day 9: Unit 11 Concept Check Part 1 (60 mins)

Standards:

- 5.1: Concepts of population, sample, random sample, discrete and continuous data. Presentation of data: frequency distributions (tables); frequency histograms with equal class intervals; box-and-whisker plots; outliers. Grouped data: use of mid-interval values for calculations; interval width; upper and lower interval boundaries; modal class.
- 5.2: Statistical measures and their interpretations. Central tendency: mean, median, mode. Quartiles, percentiles. Dispersion: range, interquartile range, variance, standard deviation.
- 5.3: Cumulative frequency; cumulative frequency graphs; use to find median, quartiles, percentiles
- 5.7: Concept of discrete random variables and their probability distributions. Expected value (mean), E(X) for discrete data.
- 5.8: Binomial distribution. Mean and variance of the binomial distribution.
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Students will be able to...

- interpret frequency tables, frequency histograms, and cumulative frequency graphs
- determine if there are outliers present in a data set
- create boxplots based on given information
- determine variance and standard deviation for a data set
- create probability distributions to represent different scenarios
- find the expected value of a data set based on a probability distribution
- calculate the probability of binomially distributed events
- calculate expected value and variance given a binomial distribution
- calculate the probability of normally distributed events
- calculate expected value and variance given a normal distribution

Materials:

- Unit 11 Concept Check Part 1 (formal assessment)
- Unit 11 Concept Check Part 1 Key

Facilitator Guide:

- The teacher will assign the **Unit 11 Concept Check Part 1.**
- The students will complete the concept check in Kami. **(60 mins)**
- The teacher will use the **Unit 11 Concept Check Part 1 Key** to grade the concept checks and provide feedback to the students.

Day 10: Unit 11 Concept Check Part 2 (60 mins)

Standards:

- 5.1: Concepts of population, sample, random sample, discrete and continuous data. Presentation of data: frequency distributions (tables); frequency histograms with equal class intervals; box-and-whisker plots; outliers. Grouped data: use of mid-interval values for calculations; interval width; upper and lower interval boundaries; modal class.
- 5.2: Statistical measures and their interpretations. Central tendency: mean, median, mode. Quartiles, percentiles. Dispersion: range, interquartile range, variance, standard deviation.
- 5.3: Cumulative frequency; cumulative frequency graphs; use to find median, quartiles, percentiles
- 5.7: Concept of discrete random variables and their probability distributions. Expected value (mean), E(X) for discrete data.
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- interpret frequency tables, frequency histograms, and cumulative frequency graphs
- determine if there are outliers present in a data set
- create boxplots based on given information
- determine variance and standard deviation for a data set
- create probability distributions to represent different scenarios
- find the expected value of a data set based on a probability distribution
- calculate the probability of binomially distributed events
- calculate expected value and variance given a binomial distribution
- calculate the probability of normally distributed events
- calculate expected value and variance given a normal distribution

Materials:

- Unit 11 Concept Check Part 2 (formal assessment)
- Unit 11 Concept Check Part 2 Key

Facilitator Guide:

- The teacher will assign the **Unit 11 Concept Check Part 2.**
- The students will complete the concept check in Kami. **(60 mins)**
- The teacher will use the **Unit 11 Concept Check Part 2 Key** to grade the concept checks and provide feedback to the students.

References

Alei, B. (2014). IB Math – Standard Level – Probability Practice 2. http://users.desertacademy.org/balei/Math/SL/SLProbPractice2.pdf